Request for Economic Stimulus Funds

Concept Proposal

Submitters (Name of Workgroup & Chair/Co-Chairs):

Robin Zhang, Haluk Cetin and Kate He, Murray State University

Project Title:

Spectral profiling and mapping of invasive and native plant species in western Kentucky

Project Partners (Known or Anticipated):

Dr. Tom Mueller, Soil and Water Conservation and Management, University of Kentucky

Dr. Robert O. Green, Jet Propulsion Laboratory, NASA

Dr. Songlin Fei, Department of Forestry, University of Kentucky

Project Background & Purpose (Justification for Project):

The invasion of alien plants has serious ecological and economic consequences. Management and control of biological invasion has been a great challenge for researchers and the general public. The success of our management efforts depends on documenting, monitoring and modeling of the spatial distribution of the invaders. The current distribution of the invasive plants is poorly mapped; the path of dissemination is sketchy; and the mechanism of spatial dispersal is mostly unclear. Accurate mapping of the invasive plants would be the very first step in controlling and preventing further spread of the invaders.

It is very time consuming, expensive and at times impossible to repeatedly map and monitor the spatial distribution of invasive plants by field-based methods for an area as small as a county. Remote sensing based methods provide a more realistic and effective alternative. High spatial resolution aerial and satellite imagery has been used to map invasive plants at various geographic locations. To accurately distinguish invasive plants from other co-occurring plant species in the field, hyperspectral imagery with fine spatial resolution holds the key.

To detect invasive plants using hyperspectral imagery, the spectral profile of plants, both native and invasive, need to be characterized. There is currently no such spectral library exists for plant species in Kentucky. This project would be the first towards spectral profiling and building of a spectral library for common plant species, both native and invasive, in western Kentucky. The project can be expanded to entire Kentucky. The mapping of invasive plants would establish a baseline for further monitoring and modeling of the spread of the species and the effectiveness of management approaches. Further, information of native plants, possibly including threatened and endangered species gathered through this project could tremendously enhance conservation effort and strategies in the region. The interdisciplinary research will greatly benefit the undergraduate and graduate students involved.

Project Description (General Goals & Implementation Strategies):

The goal of this project is to establish the spectral signatures of common native and invasive plant species in western Kentucky, and use the spectral signatures to identify the species in hyperspectral remote sensing imagery. The underlying hypothesis is that each plant species have its unique spectral signature due to differences in plant physiology and phenology. Once the spectral signatures are collected in the field at known plant stands and calibrated, the spectral signatures can be used to identify the species in hyperspectral imagery.

The project plan: 1) Collect field spectra of common plants using a field spectrometer and record the locations of the plant stands using a GPS unit, at multiple times during the growing season; 2) Calibrate the field spectra and build a spectral library of common plants found in western Kentucky; 3) Collect hypersepctral remote sensing data, such as imagery acquired by the AVIRIS sensor of NASA's Jet Propulsion Laboratory; 4) Mapping of the plants using remotely sensed data and the field spectral library.

Project Team (Project Manager(s), Content Experts, Instructional Designers, etc.):

Managers: Robin Zhang, Haluk Cetin and Kate He

Content experts: Robin Zhang, Haluk Cetin, Kate He, Tom Mueller, Robert Green, Songlin Fei

Project Budget & Amount of Economic Stimulus Funds Requested:

Estimated budget: $700-800,000

Economic Stimulus Funds Requested: $700,000 – 800,000